HYDROPONIC PLANT GROWTH SYSTEM AND METHOD

CROSS-REFERENCES TO OTHER RELATED PATENT APPLICATIONS

[0001] Not Applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable.

REFERENCE TO SEQUENCE LISTING, A TABLE, OR A COMPUTER PROGRAM LISTING COMPACT DISK APPENDIX

[0003] Not Applicable.

BACKGROUND OF THE INVENTION

[0004] The present invention relates generally to the field of plant growing systems and methods, and more specifically plant growth systems using hydroponics. Hydroponic growth methods typically grow plants in water with special chemicals or nutrients added, and this method is typically used in growing outside the earth and without soil. Hydroponic methods use a variety of ways to provide water, nutrients and oxygen to the plants. In a simple method, passive hydroponics, a plant is planted in a container (pot or bag) of growing medium, and the container stands in a tray of nutrient solution. The simple system is maintained by topping off the level of the nutrient solution and occasionally replacing the nutrient solution.

[0005] Some other common methods are the "flood/drain" method and the "flow" method. In the flow method, also known as drip feeding, a pump is used to deliver a continuous trickle of liquid nutrient through a cultivation area where plant seeds or young plants are accommodated.

In typical "flood/drain" methods, a large open tray sits above a reservoir of nutrient solution. The tray can be filled with a growing medium, for example clay granules. Plant seeds or young plants, typically accommodated in slotted pots or slotted bags, are placed in the tray. A pump fills the upper tray with nutrient via the inflow/outflow valve until the tray fills and the nutrient drains back down into the reservoir via the overflow valve. This action allows the medium to be regularly flushed with nutrient and air. The pump is typically controlled by a timer which is programmed to repeat this cycle at regular intervals. Once the pump is shut off, the nutrient remaining in the tray drains back out the inflow/outflow valve into the reservoir.

[0006] Most hydroponic techniques, dispensing with the use of soil, use relatively inert materials as a physical support for the plant roots. Other techniques dispense altogether with any growing medium, delivering nutrient solution directly to the roots, by a variety of methods. Generally, a liquid nutrient composition is circulated through a cultivation portion where the plant seeds or young plants are anchored and grown. Water and nutrients are delivered to the roots via capillary action, as the medium generally has large air spaces, allowing ample oxygen and nutrients to reach the roots of the young plants and seeds. A variety of materials can be used for the medium: vermiculite, perlite, clay granules, hydrostone, rockwool, gravel, coir fibre, and cocoa bean shells.

BRIEF SUMMARY OF THE INVENTION

[0007] The present invention combines the very common "flood/drain," also known as the "ebb and flow" method found in traditional flat rectangular hydroponic trays with one or more vertically positioned light sources. One embodiment of the present invention includes a plant growth system consisting of a vertically positioned source of light, a reservoir, a pump, a volume of liquid based nutrient composition, a plurality of independent growing chambers arranged in a planar array around said one or more sources of light, each of said growing chambers comprising a container portion with a base and sides, an inflow/outflow gate accommodated in the base of said container portion, an height adjustable overflow gate accommodated within said container portion, and drainage plumbing connecting said container portion with said reservoir, and wherein each of said growing chambers accommodates one or more plant holding containers, wherein when said pump is activated, said pump transports said nutrient composition from the reservoir through the inflow/outflow gate into said growing chambers, and wherein when one of said growing chambers becomes flooded to the level of said overflow gate, said overflowing nutrient composition is returned to said reservoir via said drainage plumbing, and wherein when said pump is deactivated, said nutrient composition remaining in each growing chamber returns to the reservoir via the inflow/outflow gate.

[0007] Another embodiment of the present invention includes a plurality of vertically positioned sources of light.

[0008] Another embodiment of the present invention is comprised primarily of a polyethylene material.

[0009] Another embodiment of the present invention has a plurality of inflow/outflow gates instead of a single inflow/outflow gate.

[0010] Another embodiment of the present invention has a plurality of overflow gates instead of a single overflow gate.

[0011] Another embodiment of the present invention includes a timer to activate and deactivate the pump.

[0012] Another embodiment of the present invention is a plant growth method comprising the steps of: activating a pump wherein said pump transports said nutrient composition from the reservoir through the inflow/outflow gate into said growing chambers; and wherein when one of said growing chambers becomes flooded to the level of said overflow gate, said overflowing nutrient composition is returned to said reservoir via said drainage plumbing; and deactivating said pump wherein said nutrient composition that is remaining in each growing chamber returns to the reservoir via the inflow/outflow gate using an using an apparatus comprised of a vertically positioned source of light, the reservoir, the pump, the volume of liquid based nutrient composition, a plurality of stacked independent growing chambers arranged in a planar array around said one or more sources of light, each of said growing chambers comprising a container portion with a base and sides, an inflow/outflow gate accommodated in the base of said container portion, an height adjustable overflow gate accommodated within said container portion; and drainage plumbing connecting said container portion with said reservoir wherein each of said growing chambers accommodates one or more plant holding containers.

[0013] Having thus described embodiments of the present invention, it is the principal object of the present invention to provide an improved hydroponic growing chamber.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0014] The above and other objects, advantages and features of the present invention will be more readily apparent from the following description, when read in conjunction with the accompanying drawings wherein:

[0015] FIG. 1 is a perspective view of an embodiment of the present invention;

[0016] FIG. 2 is breakaway partial side view of the growing chamber of an embodiment of the present invention;

[0017] FIG. 3 is an end cut away view of a growing chamber of an embodiment of the present invention;

[0018] FIG. 4 is a side cut away view of a growing chamber of an embodiment of the present invention;

[0019] FIG. 5 is a partial perspective view of a growing chamber of an embodiment of the present invention;

[0020] FIG. 6 is a partial perspective view of a growing chamber of an embodiment of the present invention;

[0021] FIG. 7 is a partial perspective view of a growing chamber of an embodiment of the present invention;

[0022] FIG. 8 is a partial perspective view of a growing chamber of an embodiment of the present invention;

[0023] FIG. 9 is a top perspective view of a growing chamber of an embodiment of the present invention;

[0024] FIG. 10 is a top perspective view of a growing chamber of an embodiment of the present invention;

DETAILED DESCRIPTION OF THE INVENTION

[0025] Turning now descriptively to the drawings, in which similar reference characters denote similar elements throughout several views, Figures 1 through 13 illustrate an embodiment of the hydroponic growing system designated generally by the numeral **10**. In this system **10**, a liquid nutrient composition is circulated through a cultivation portion consisting of a plurality of growing chambers **12**. Growing chambers **12** can be formed in the shape of a tray, a tube, or a circular shaped container, or any suitable form for accommodating plant pots or bags.

[0026] FIG 1. illustrates an embodiment of system **10** which is made up of three independently plumbed growing chambers **12** set upon a support structure **14.** The two uppermost growing chambers **12** are in the form of an eight sided octagon. The lowermost positioned growing chamber **12** shown is made up of seven sides and includes two polyethylene end caps **16** so that said lowermost chamber **12** is sealed on both ends. Plant pots **18** (shown containing young plants) are positioned to seat individually into openings **20**. Each Pot **18** has a diameter of 5" at its top end and each is tapered so that the pot **18** can be slide and fit securely into opening **20**. Each growing chamber **12** has a plurality of openings **20** in the tops of the chambers **12** in order to accommodate various sized plant pots **18** or plant holding bags. FIG. 2 illustrates a side breakaway view of a plant pot **18** as it is seated into a section of growing chamber **12**.

[0027] Growing chambers **12** can also accommodate one or more sizes of plant pots **18**, bags, or the like. Commonly used sizes of plant pots **18** are diameter sizes of 5", 4" and 3." The plant pots **18** or bags have openings or slots to allow the nutrient liquid to flow through the pots or bags to the roots or seeds. The scope of the invention is not limited to plant pots or bags, as the

present invention can easily be modified to hold any other object wherein the plant seeds or young plants are anchored.

[0028] Growing chambers **12** are individually stacked or set upon support structure **14**, which is also constructed of a plastic piping. Growing chambers **20** can also be supported by other means such as with horizontal shelf supports, support wires or similar support means. The support structure **14** is at a level pitch and is positioned above reservoir tank **22** (not shown.) More than one reservoir tank **22** can also be used instead of a single reservoir tank **22**.

[0029] A commercially available vertical hung light fixture **24** is placed on the ground or hung from the ceiling and anchored at the floor. Fixture **24** provides the source of light needed to plant growth. Fixture **24** can also be used with no anchoring, and fixture **24** can further be made up of several individual sources of light.

[0030] Each growing chamber **12**, both with and without end caps **16**, is comprised of a pipe or a tray style container with at least a base with two sides and each growing chamber **12** includes an inlet/outlet gate **32** located at the base of growing chamber **12**, an overflow gate **34**, and drain plumbing **36**, and each growing chamber **12** is primarily made up of piping, plastic fittings and molded plastic pieces. FIG. 3 illustrates a view from an open end of an embodiment of a growing chamber **12** with an inlet/outlet gate **32** and an overflow gate **34** using compression fittings **38** and connected to drain plumbing **36** via hose **42** which has a barbed connection to secure the hose in place. The diameter of the inlet/outlet gate **32** as well as the overflow gate **34** is ¾" and the diameter of hose **42** is 3/8". FIG 4. illustrates a side view of an embodiment of a growing

chamber **12** with examples of an inlet/outlet gate **32** positioned near the base of chamber **12** and an adjustable overflow gate **34** which is positioned near the top of chamber **12**. The overflow gate **34** is adjustable by the user to various height levels.

[0031] The growing chambers **12** can be constructed of a plastic polymer such as PVC, plastic pieces or any like material. Figures 5 through 8 illustrate various embodiments of the base and two sides in the growing chamber **12**. These illustrations do not show inlet/outlet gate **32**, overflow gate **34** or drain plumbing **36**.

[0032] Illustrated in FIG. 9 is a top view of the upper two growing chambers **12** of the three growing chambers **12** shown in system **10**. Each has eight sides which are approximately 25" in length and which are connected by 45 degree elbow joints. Each of these growing chambers **12** also has a plurality of 1/2" vent holes **44**. Some sections are joined by a 6" length plastic coupler **46**. The diameter (from the exterior walls of each side) of the growing chamber **12** as illustrated in FIG. 9 is 72" and the diameter of the interior open space is 66". Illustrated in FIG. 10 is a top view of the lower most growing chamber **12** of the three growing chambers **12** shown in system **10**. This growing chamber 12 has seven sides and two end caps **16** placed on each end to seal the lowest positioned growing chamber **12**.

[0033] Using the "flood/drain" method, in contrast to the "flow" method wherein nutrient solution is provided to the plants in a flow that moves from top to bottom, the plants and plant seeds in the growing chambers **12** of the present invention are flooded from the bottom portion at the base of each growing chamber **12** until growing chambers **12** fill to the level of the overflow

gate **34**. As previously mentioned, the overflow gate **34** level is adjustable by manually raising or lowering the height of the overflow gate **34**. In other embodiments, this height can be remotely controlled. When the volume of liquid nutrient composition reaches the level of overflow gate **34**, the nutrient runs into overflow gate **34** and is returned to reservoir **22** via hose **42** and drain plumbing **36**.

[0035] Generally, when pump **48** (no shown) is activated by the user, liquid nutrient composition is pumped from reservoir **22** into the base of growing chamber 12 via inlet/outlet gate **32** until the level of liquid nutrient composition in growing chamber **12** fills to the level of the adjustable overflow gate **34**. Once the liquid nutrient reaches the level of the opening in overflow gate **34**, the liquid nutrient is returned to reservoir **22** via hose **42** and drain plumbing **36**. When pump **48** is deactivated by the user, the volume of liquid nutrient composition remaining in growing chamber 12 drains back down into reservoir **22** via inlet/outlet gate **32**. Pump 48 can be any commercially available pump suitable for pumping a volume of liquid nutrient composition.

[0036] Another embodiment uses a timer, not shown in the figures, to signal the pump to both turn on and off. In this manner, the embodiment is able to flood and drain one or more growing chambers **12** at a regular interval, or at any predetermined interval of time.

[0037] While the present invention has been illustrated and described by means of specific embodiments and alternatives, it is to be understood that numerous changes and modifications can be made without departing from the spirit and scope of the invention. Therefore, it should be

understood that the invention is not to be limited in any way except in accordance with the appended claims and their equivalents.